MODULE 4

Case Study Toolbox: Canada and Nepal

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Lesson from the Field: Success stories of mitigation measures in maintaining and enhancing connectivity – Key Takeaways

Lessons Learned from Case Studies

Banff National Park (Alberta, CANADA)
Long-term research integrating behavior, landscape ecology and conservation along the Trans-Canada Highway

Terai Arc Landcape (NEPAL)
Smart Infrastructxure Planning and Design to Protect Natural Habitats and Biodiversity, Mahendra Highway (Narayanghat-HetaudaPathlaiya)

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BANFF NATIONAL PARK

Alberta, CANADA

Trans-Canada Highway

A Big Idea: Yellowstone to Yukon Conservation Initiative

Base map provided by Y2Y

Needs for large scale connectivity

Carnivores capable of long distance movements (wolves, lynx, grizzly bears, wolverines…)

Boundaries mean nothing…

Transboundary conservation needed

Keeping the connections intact

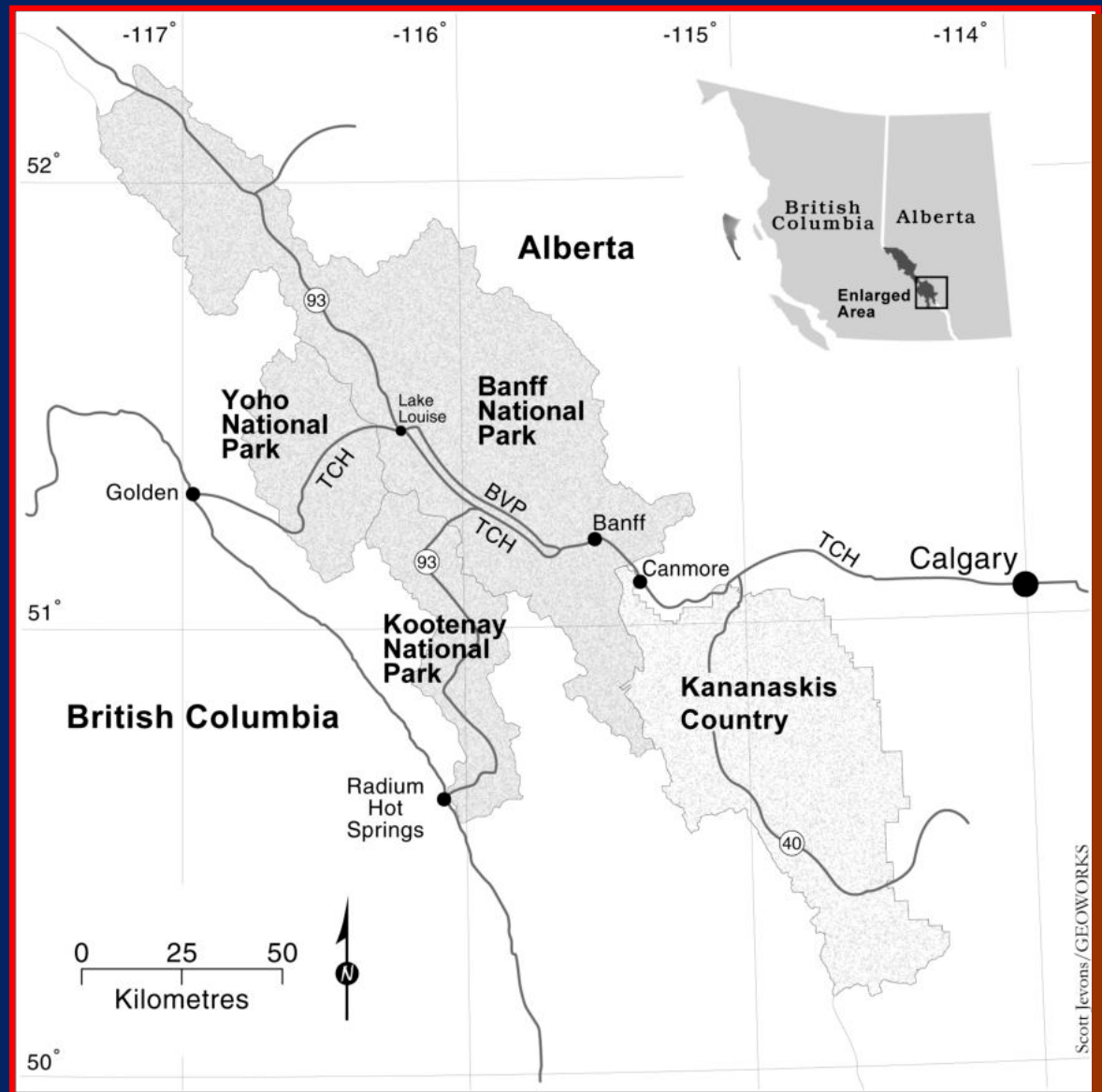
with landscape corridors and passages

Large Scale: Land Securement & Mgt

East-West Highway Systems

Local Scale: Site-Specific Measures

Trans-Canada Highway – Banff National Park, Alberta, Canada



Banff-Bow Valley

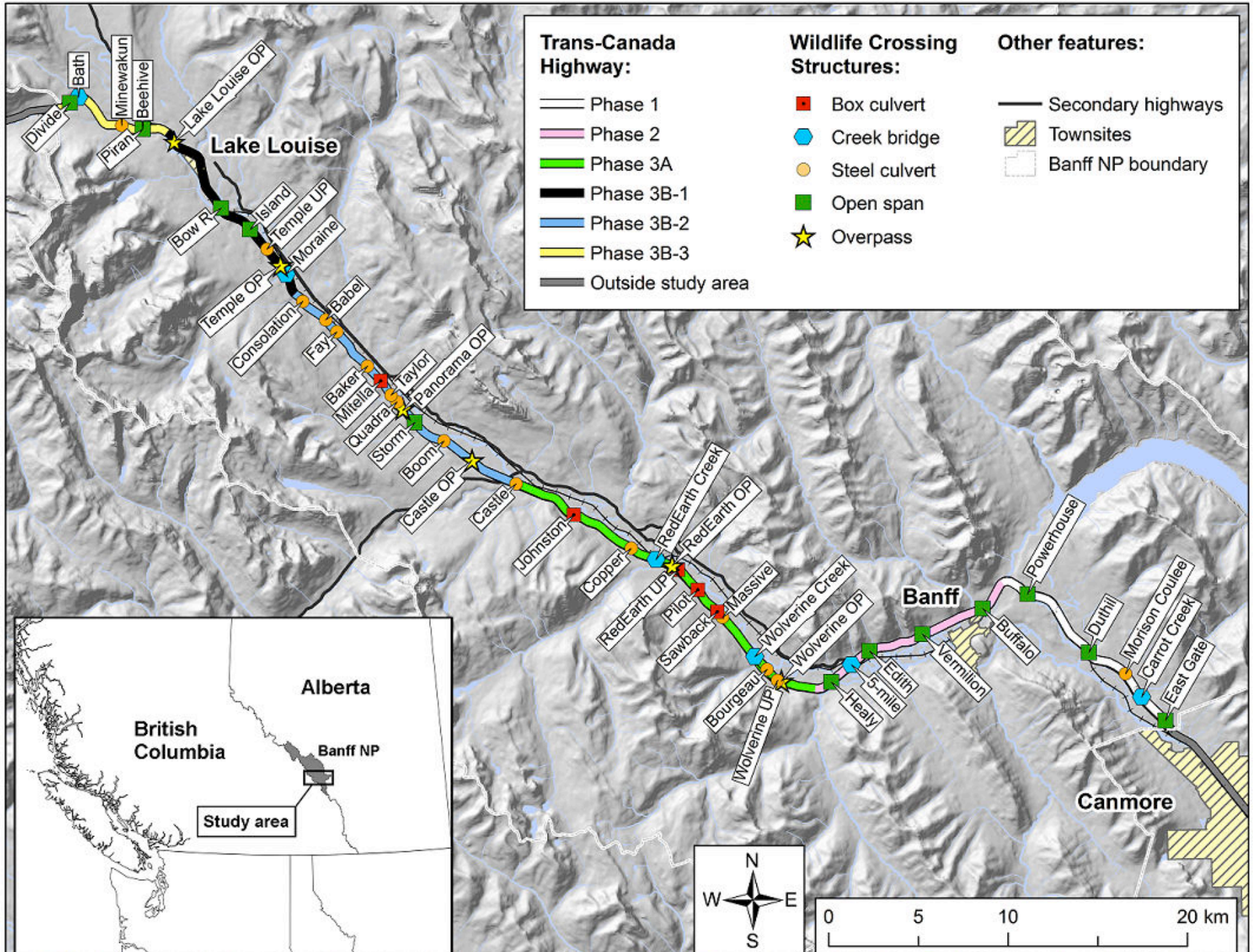
Banff NP = 6640 Km^2

4 Mountain Parks= 20,235 Km^2 (Banff, Yoho, Kootenay, Jasper)

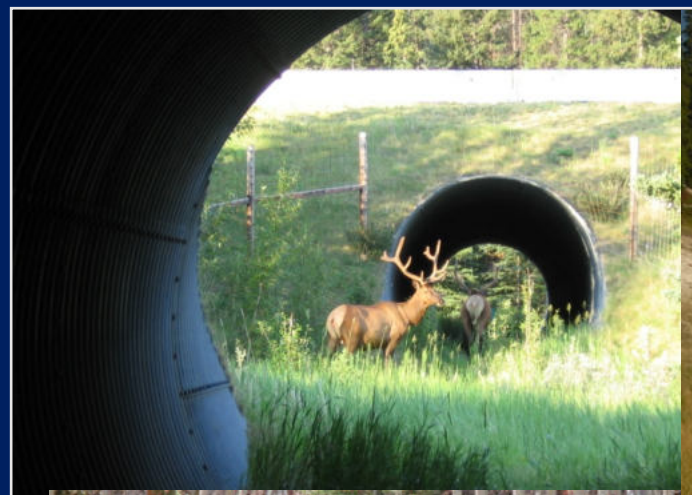
UNESCO World Heritage Site

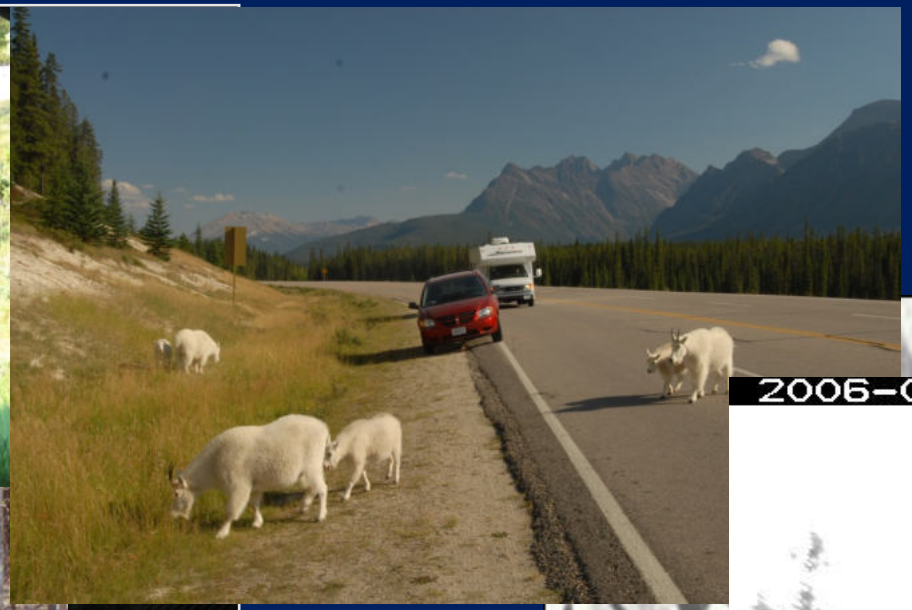
4 Million visitors per year

Large landscape context: Critical fracture zone in Y2Y ecoregion


Trans-Canada Highway:
Phase 1
Phase 2
Phase 3A
Phase 3B-1
Phase 3B-2
Phase 3B-3
Outside study area
Wildlife Crossing Structures:
Box culvert
Creek bridge
Steel culvert
Open span
Overpass
Other features:
Secondary highways
Townsites
Banff NP boundary
Lake Louise
Banff
Canmore
Divide
Bath
Minewakun
Beehive
Lake Louise OP
Piran
Bow R
Island
Temple UP
Moraine
Temple OP
Consolation
Babel
Fay
Baker
Mitella
Quadra
Taylor
Panorama OP
Storm
Boom
Castle OP
Castle
Johnston
Copper
RedEarth Creek
RedEarth OP
RedEarth UP
Pilot
Massive
Sawback
Wolverine Creek
Wolverine OP
Wolverine UP
Bourgeau
Healy
5-mile
Edith
Vermilion
Buffalo
Powerhouse
Duthil
Morison Coulee
Carrot Creek
East Gate
Alberta
British Columbia
Banff NP
Study area
N
W
E
S
0
5
10
20 km

Suite of 11 large mammal species





17 Years
(1996-2014)

?? What Did We Learn ??

?

Key Questions for Management of Highway

Does mitigation (fencing/passage) reduce wildlife mortality ?
Passages being used (Individual level) ? What species?
Are passages benefitting populations ?
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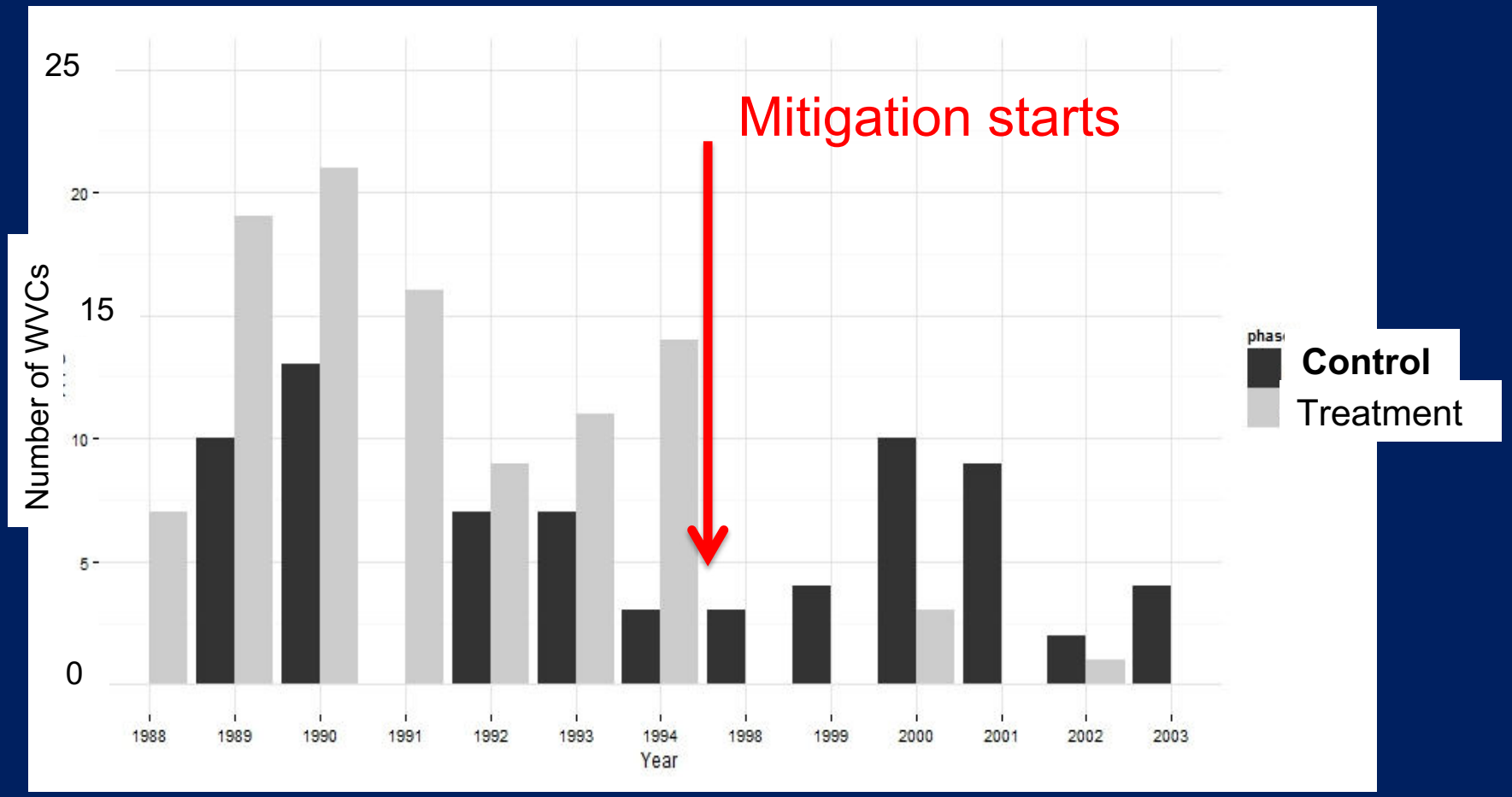
Results

Banff National Park

Number of WVCs per year on Treatment and Control sections



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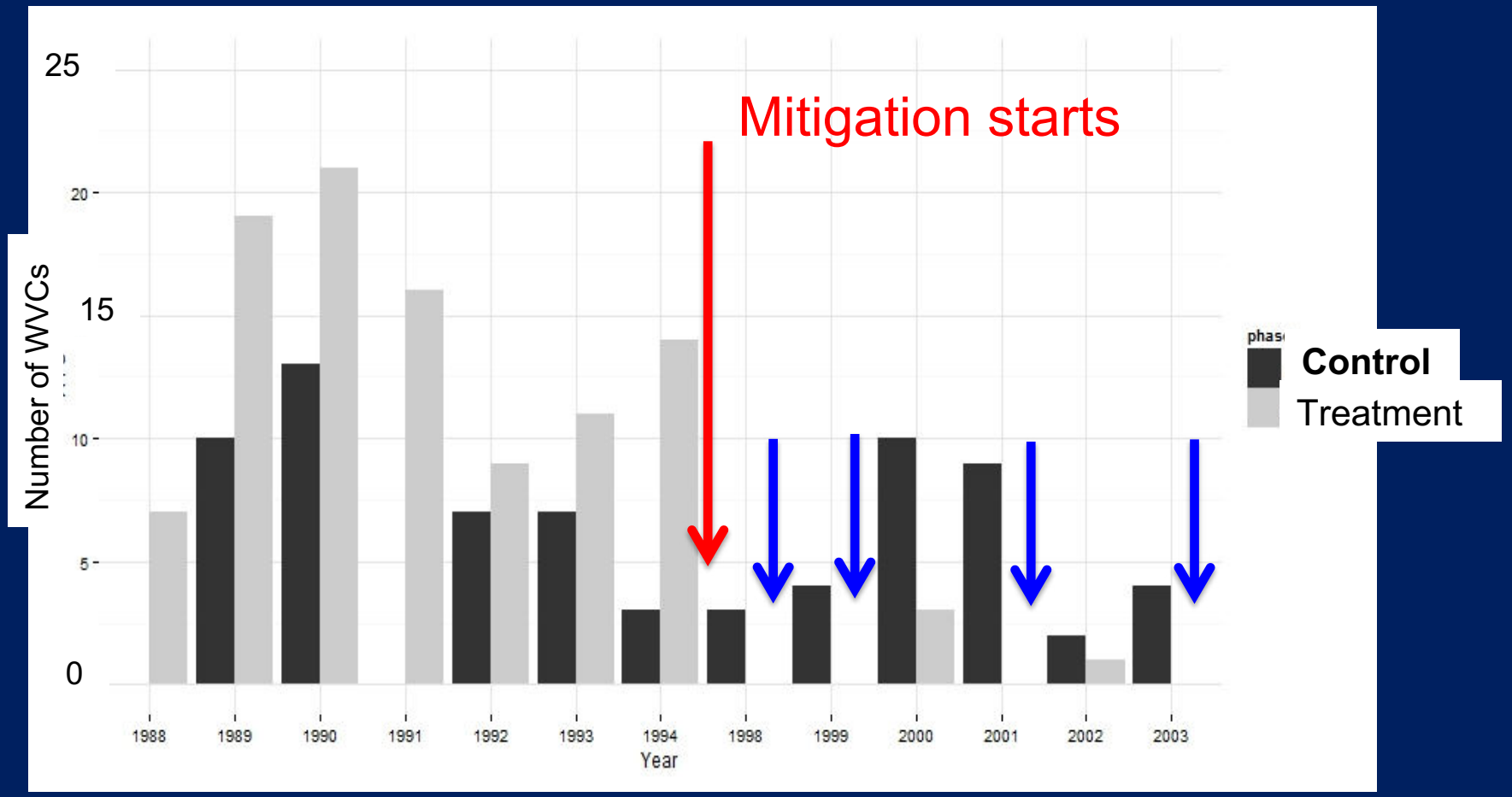

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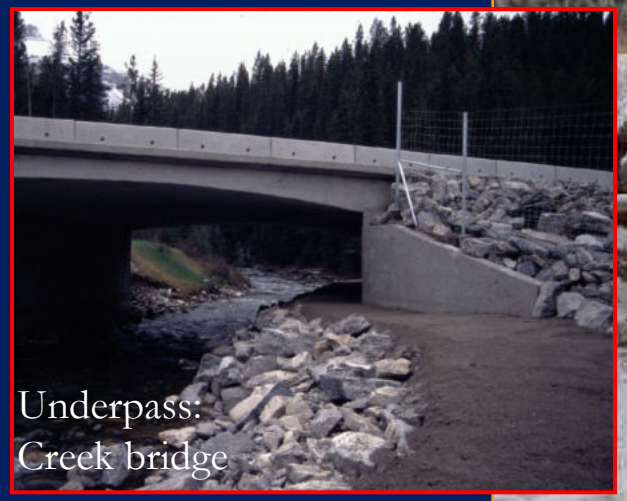
Keeping Populations Connected

Are they restoring movements ??
Are populations more connected ??

Design and Landscape Attributes for Crossing Structures



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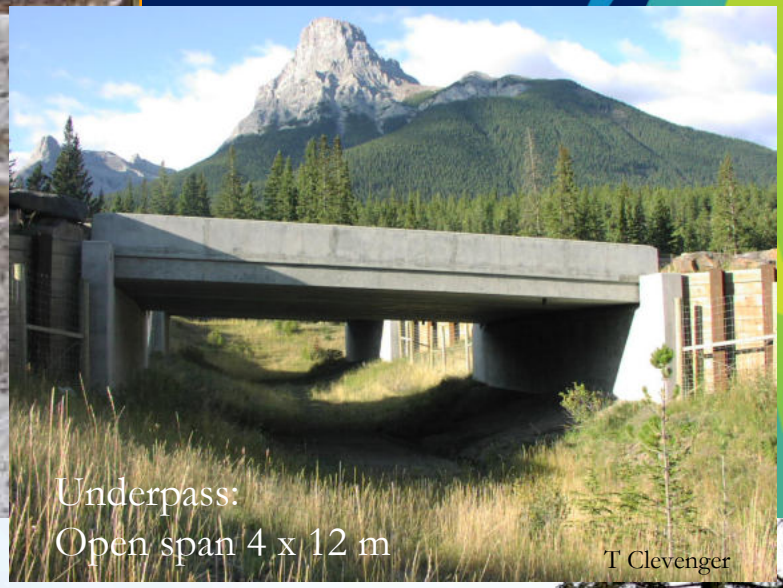

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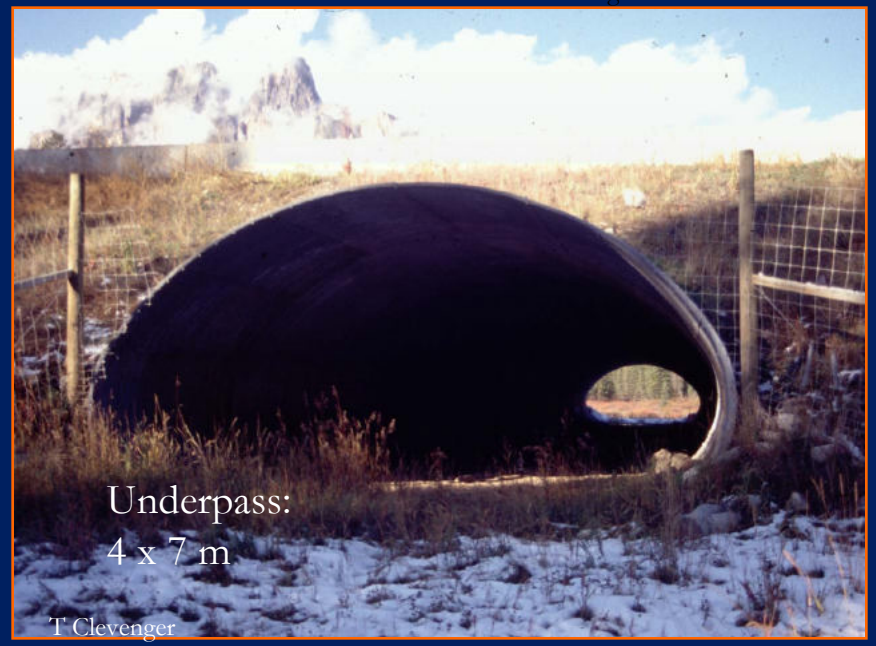

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ARC

Wildlife Crossing Structure Use

Banff National Park, Alberta

(Nov 1996 to Mar 2014)

>150,000 detected crossings
11 spp. large mammals

Ungulates	
Elk	53,251
Deer	72,857
Moose	534
Sheep	4999
Carnivores	
Black bear	1663
Grizzly bear	1549
Cougar	1627
Wolf	6826

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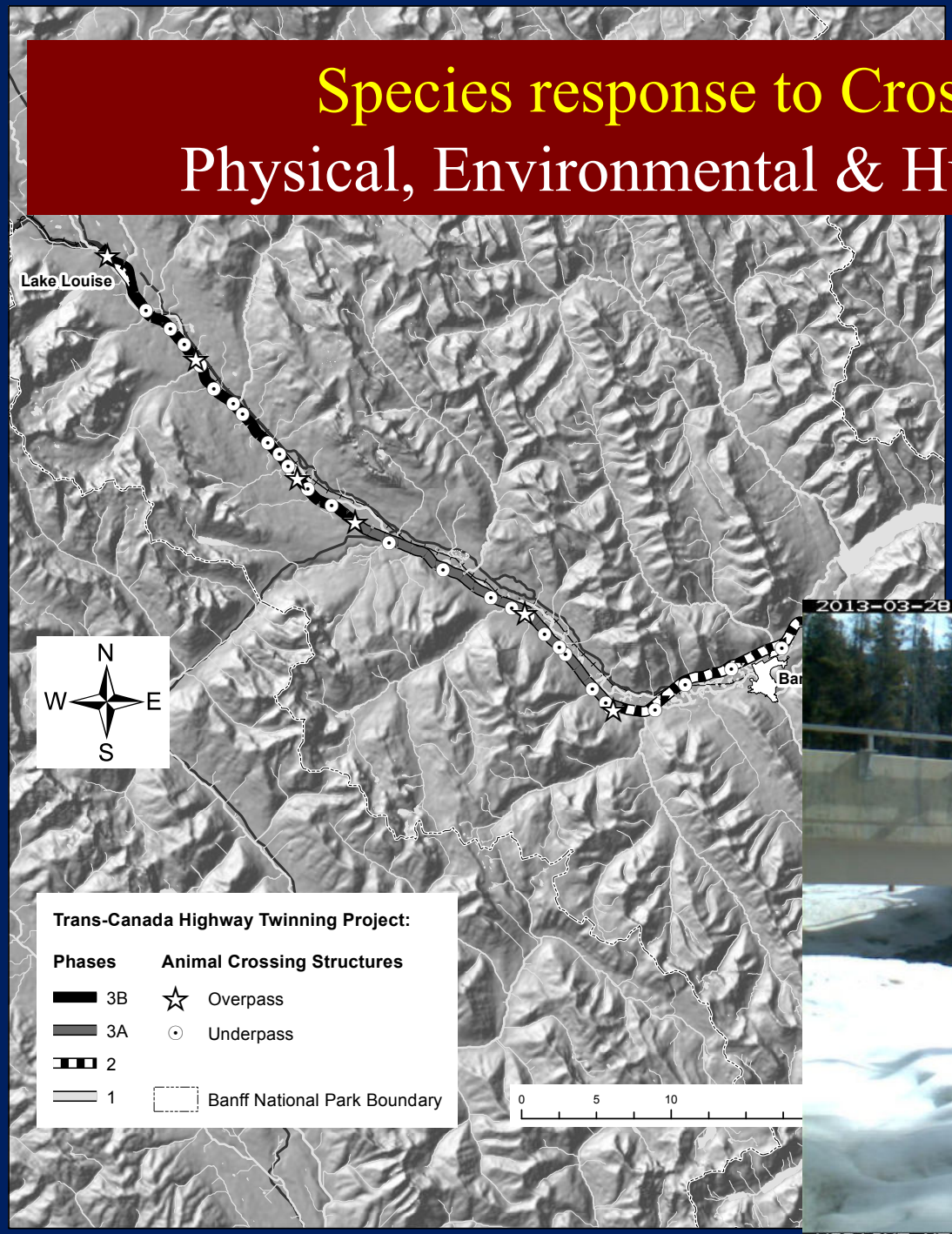
Species response to Crossing Structures
Physical, Environmental & Human Use Attributes



- Human use effects
- Species-specific needs
- Adaptation periods

Clevenger & Waltho Conserv Biol 14
Clevenger & Waltho Biol Conserv 121

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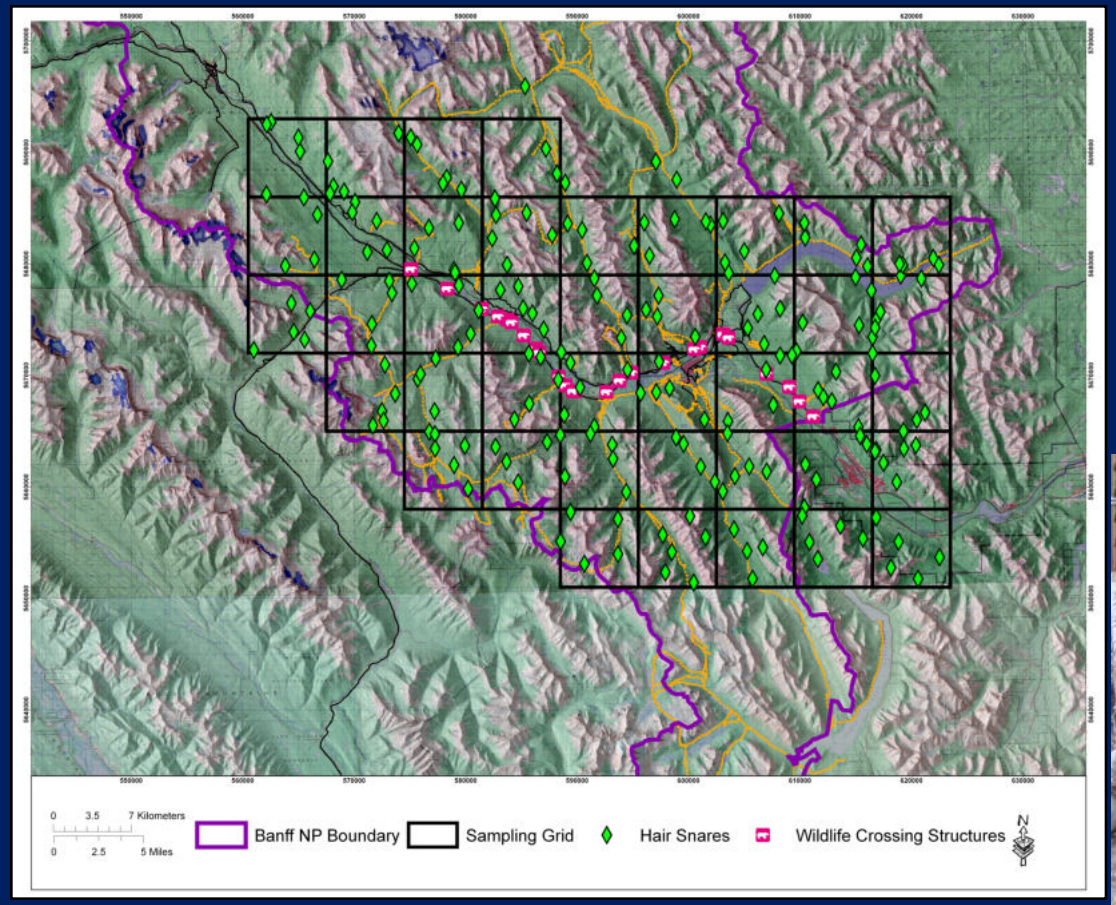
Demographic connectivity and population-level benefits



Sawaya et al 2013; Conservation Biology 27
Sawaya et al 2014; Proc Royal Soc (B) 281

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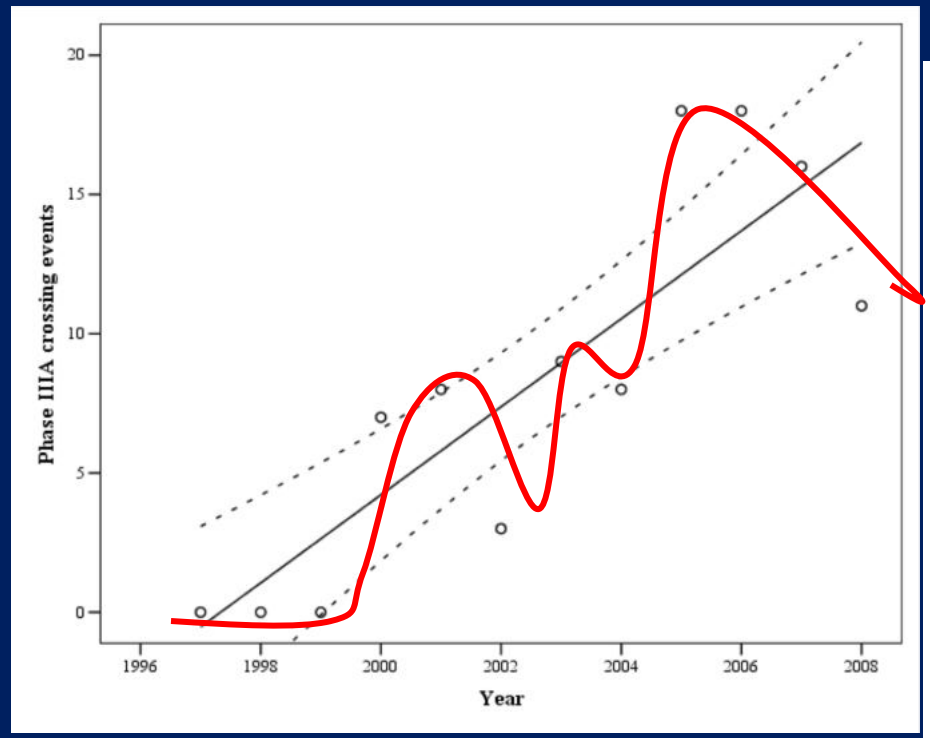
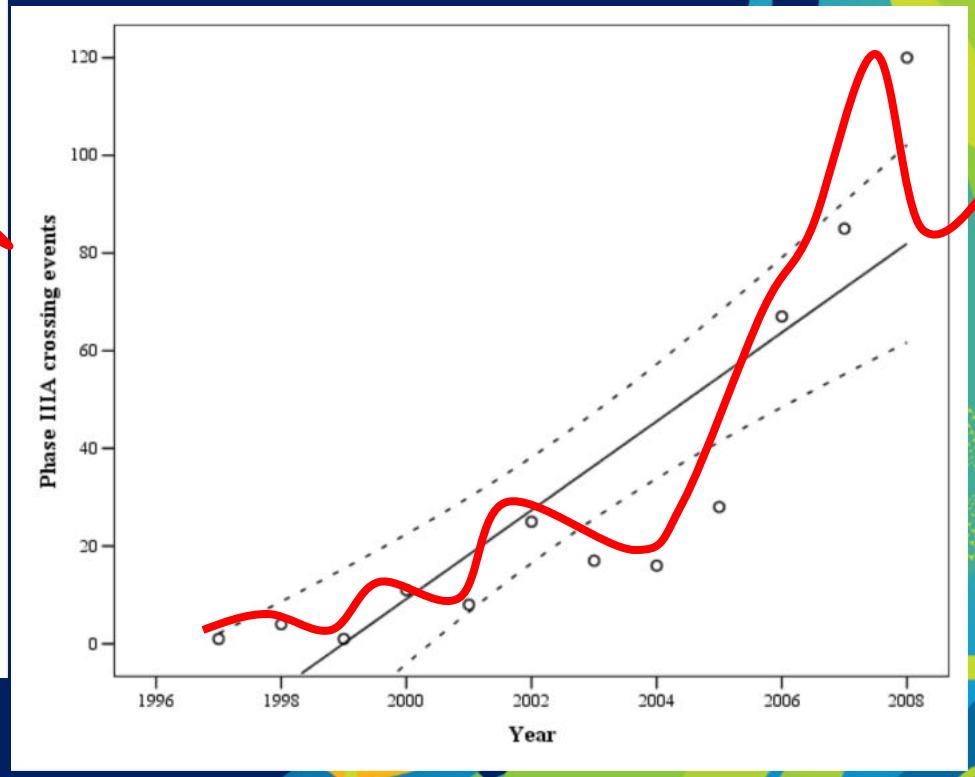
Learning and adaptation

Species-specific trends, 1997-2008



Moose



Grizzly bear

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Are crossing structures prey traps ?

Little et al. 2002. Biol Conserv 107

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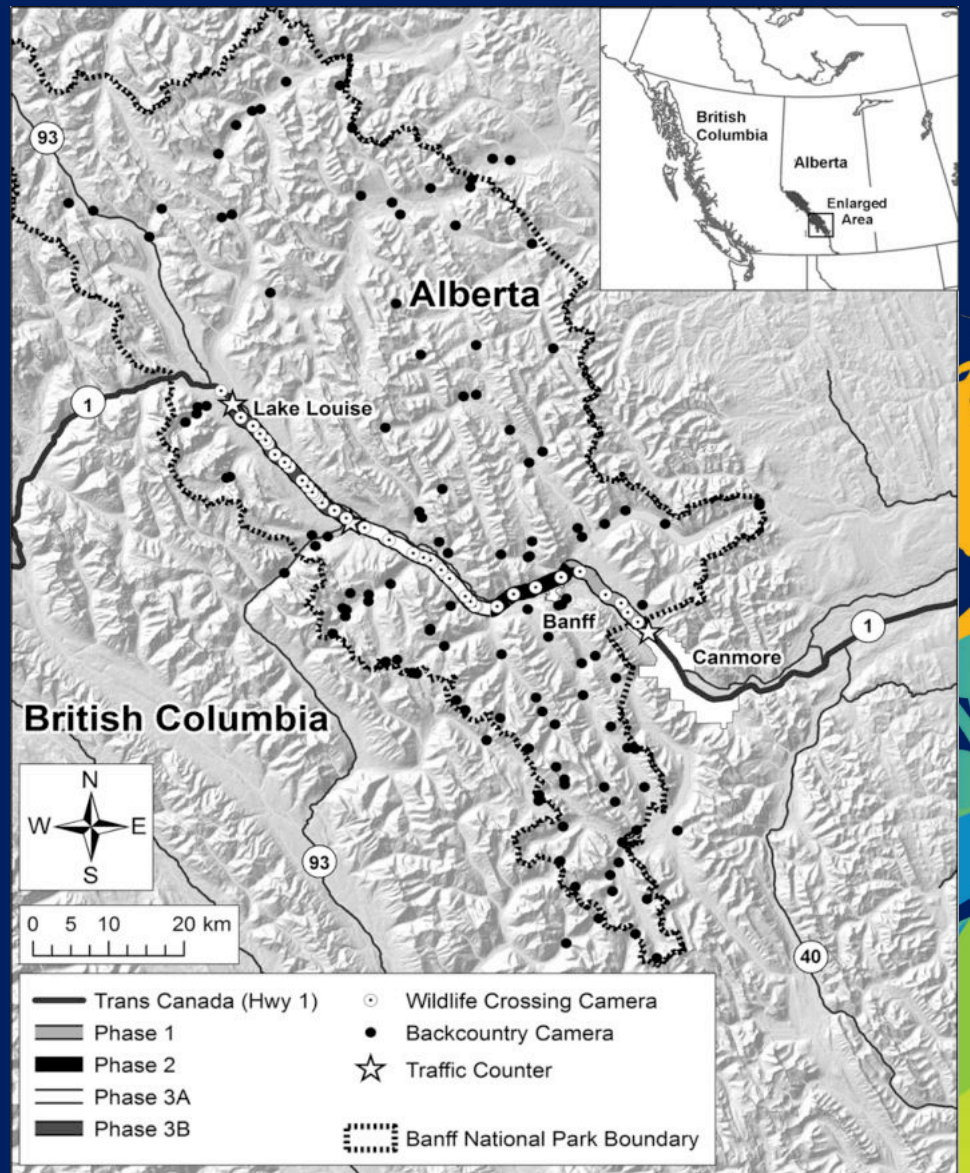
Anthropogenic effects on activity patterns of wildlife at crossing structures



Barrueto et al 2014 Ecosphere

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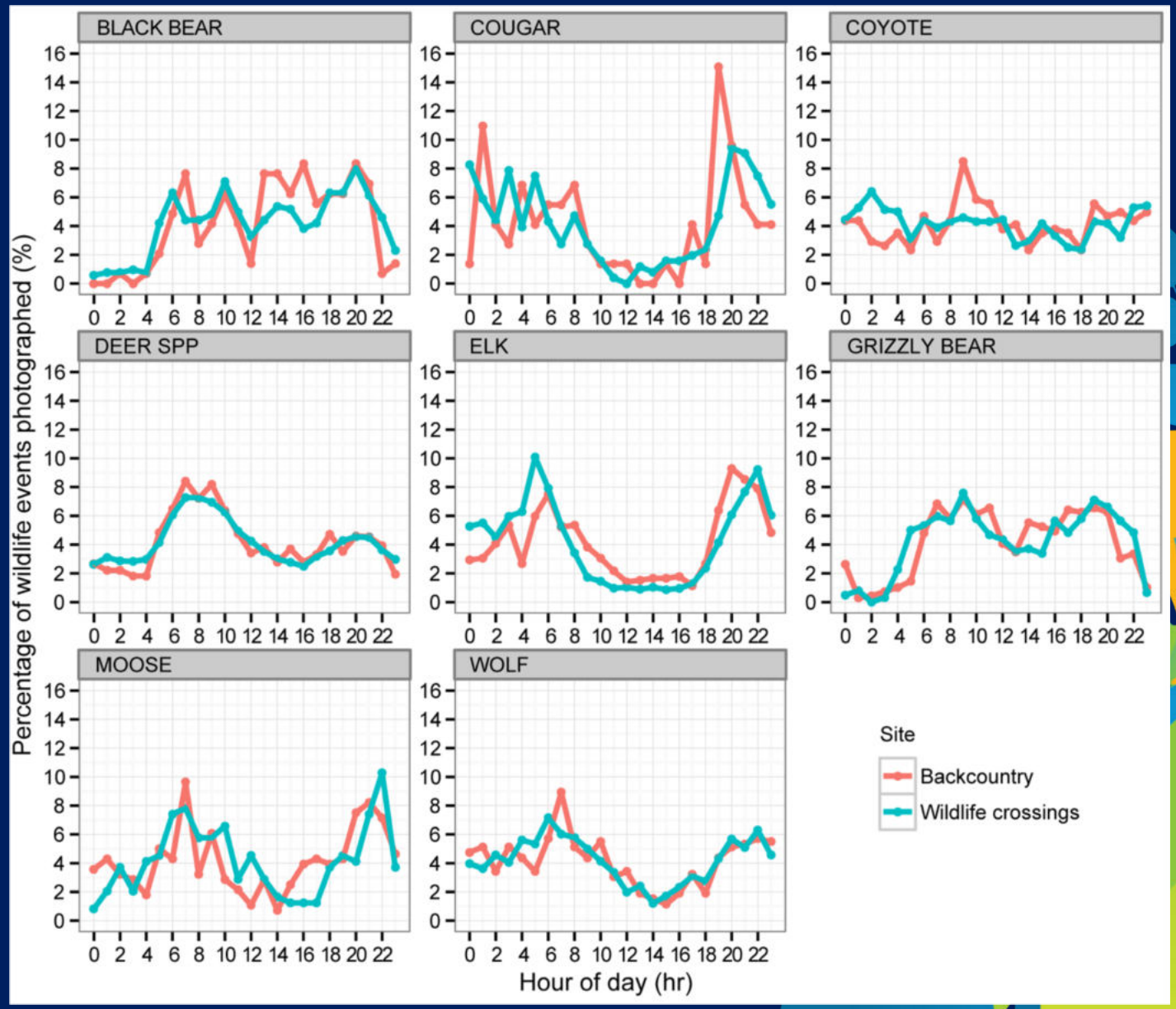

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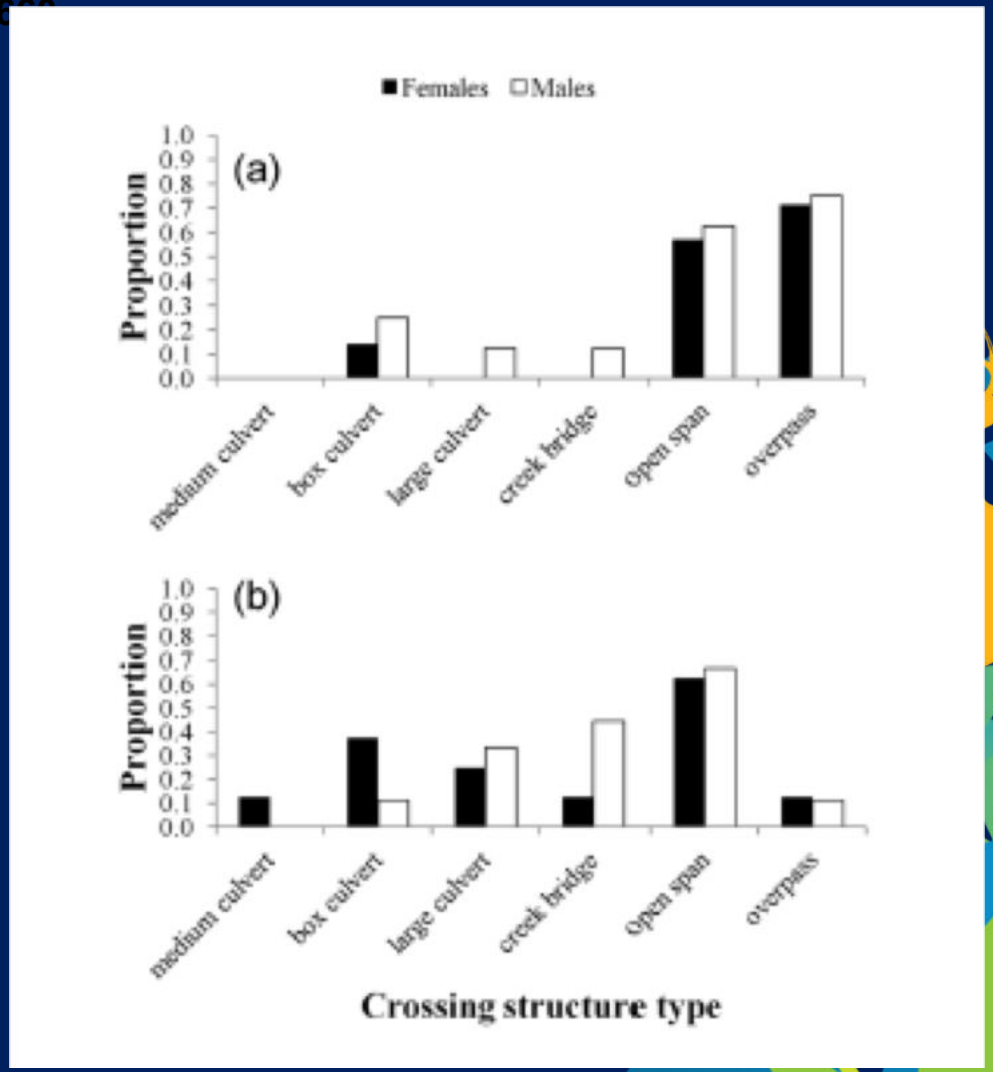
Demographic Filtering at Wildlife Crossings

Genotyping bears using crossing structures

N=6



Sawaya et al. 2013. Conservation Biology 27

Clevenger et al. 2002

Demographic filtering of Wildlife Crossing Structures

Singletons

Family units

Impact of Banff Research Results

East-West Fracture Zones

1. Hwy 75, Ketchum, ID
2. Raynolds Pass, ID
3. Togwotee Pass, WY
4. I-90 Bozeman Pass, MT
5. U.S Hwy 93, MT
6. US Hwy 95, ID
7. **Hwy 3, AB-BC**
8. Kootenay NP, BC
9. **TCH-Banff-Yoho NPs,**

* I-90 Snoqualmie Pass, WA

Impact of Banff Research Results

Diego Varela

Nevada

Argentina

Washington State

TERAI ARC LANDSCAPE

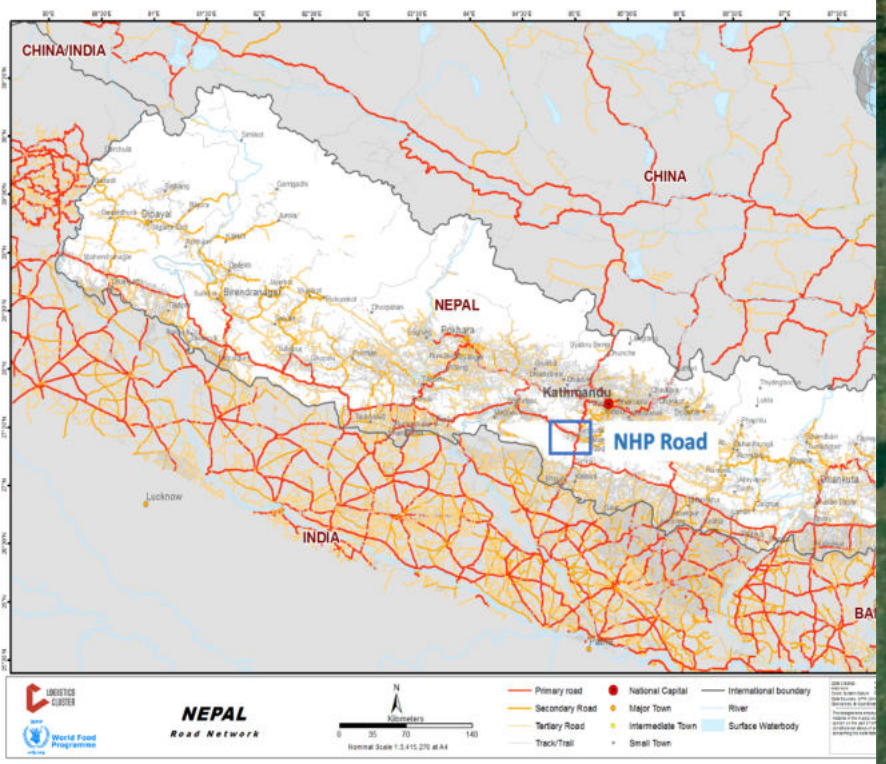
NEPAL

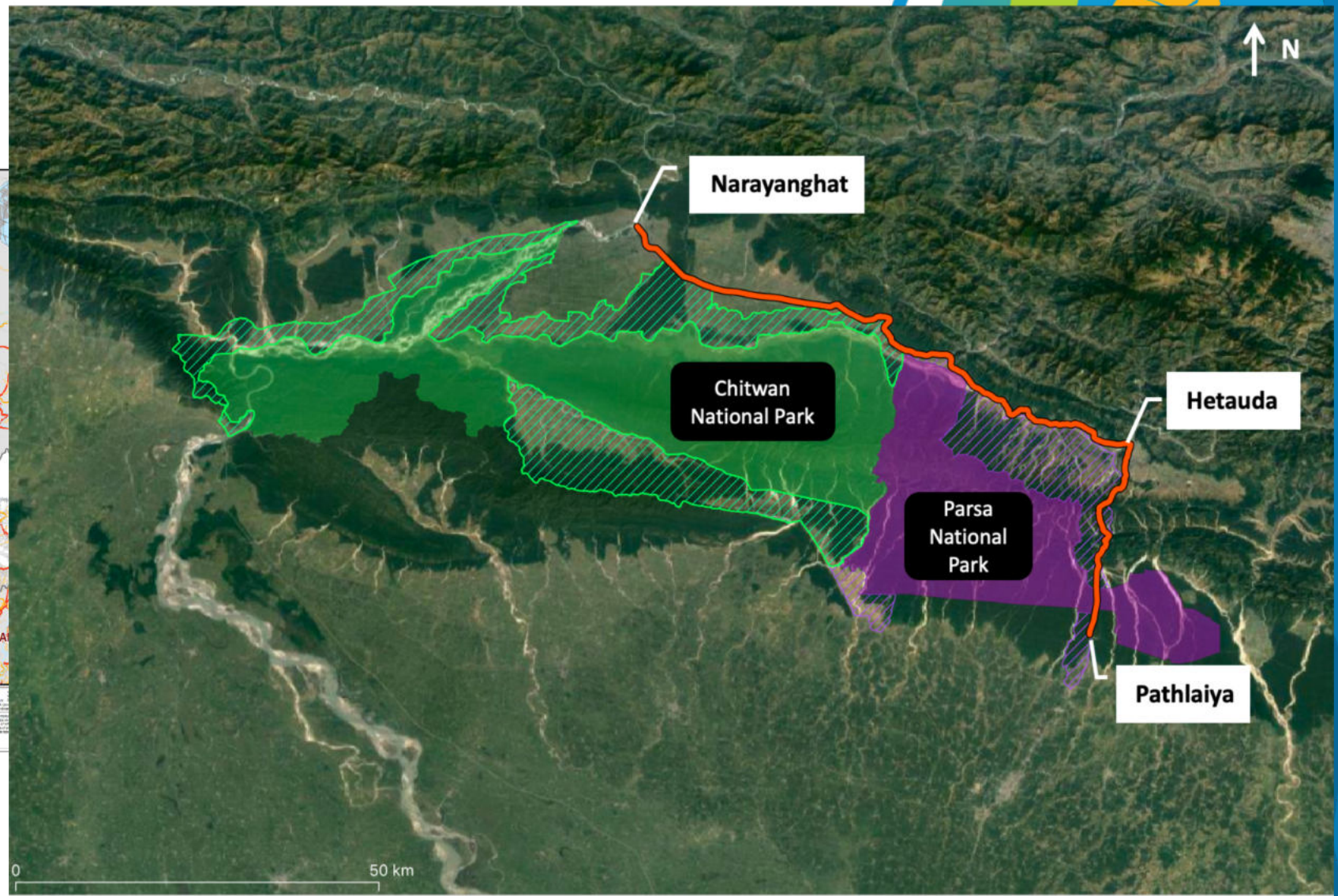
Mahendra Highway

Narayanghat-Hetauda-Pathlaiya

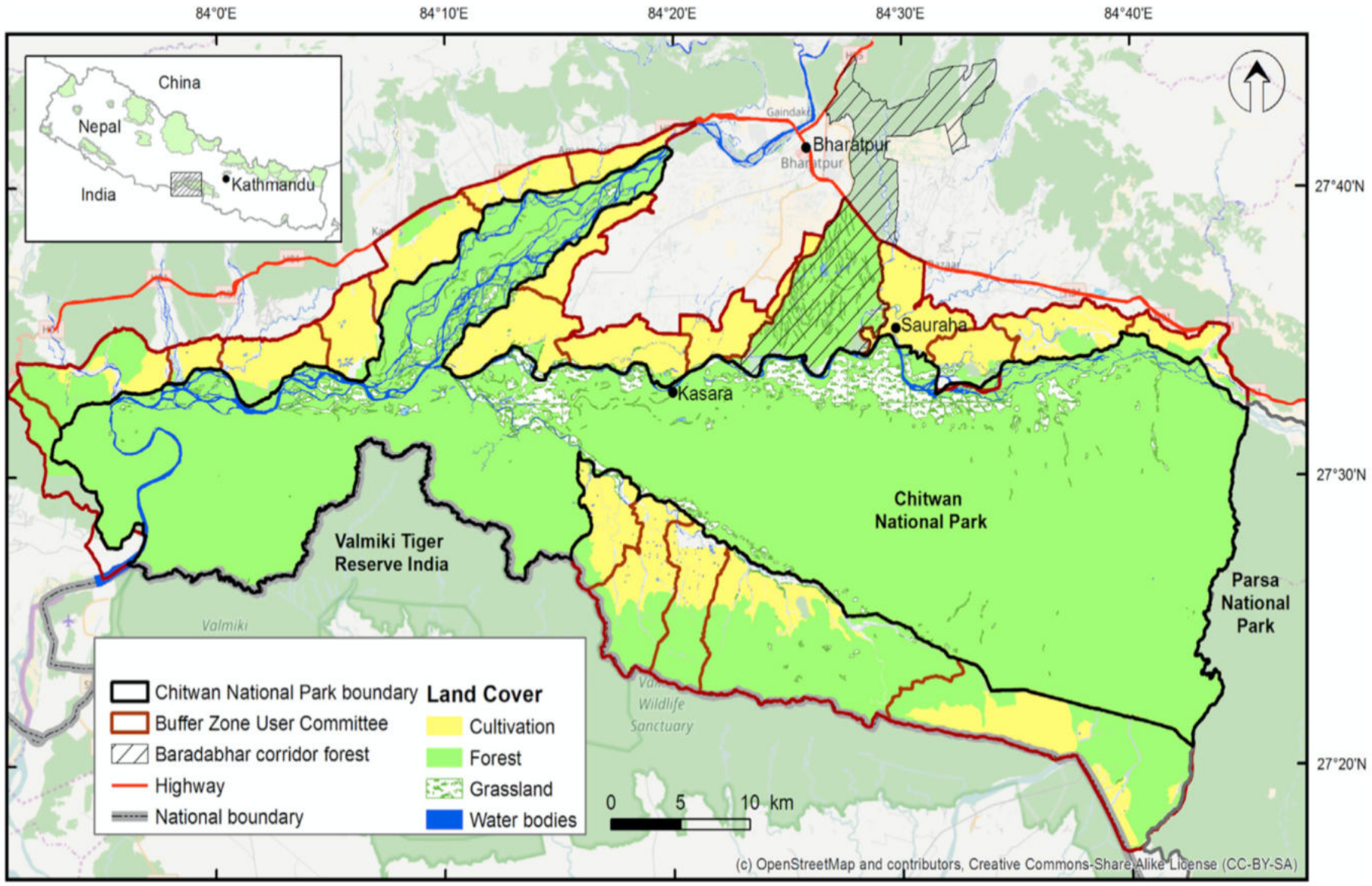
Smart Infrastructure Planning and Design to Protect Natural Habitats and Biodiversity: Ecological Assessment of the NHP Road Upgrading

ADB Technical Assistance project





LAST CHANCE LANDSCAPE



NHP Road Expansion Project

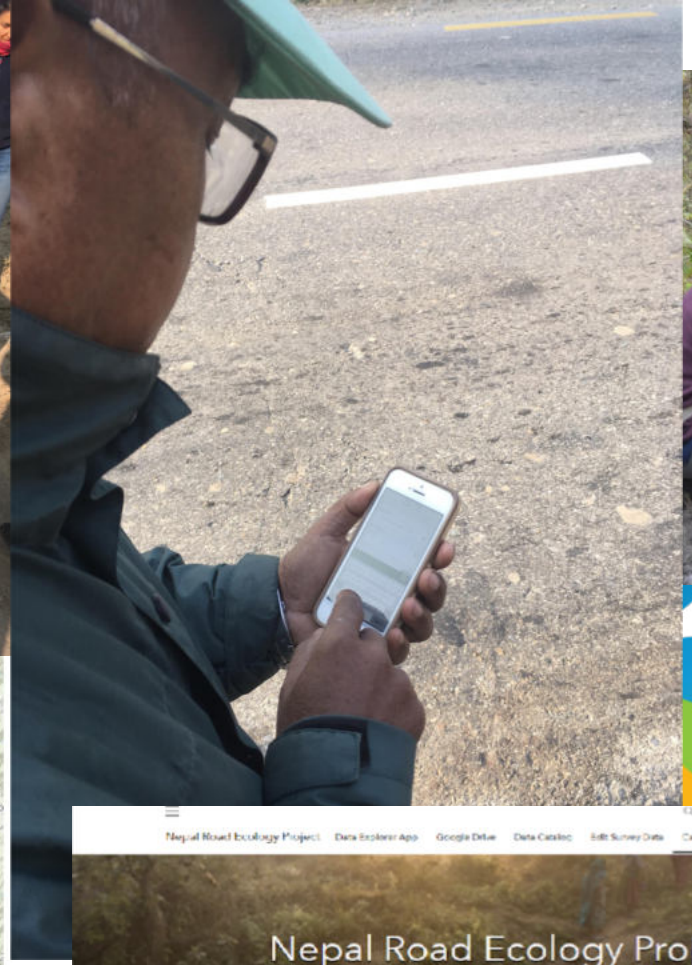
Expansion 2- to 4-lanes

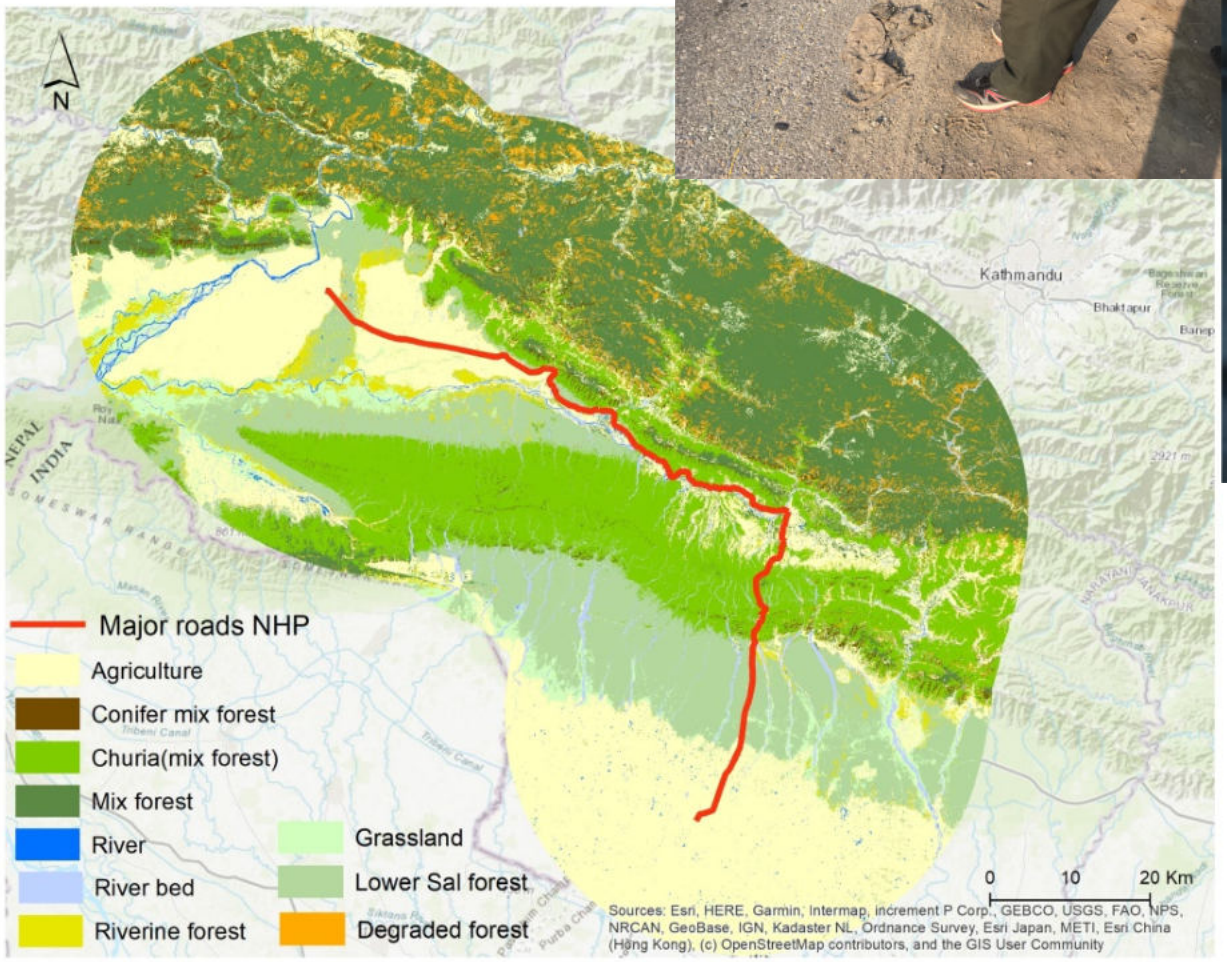
Increased Traffic volumes
Increased Mortality risk
Increased Barrier effects
Increased Pop isolation

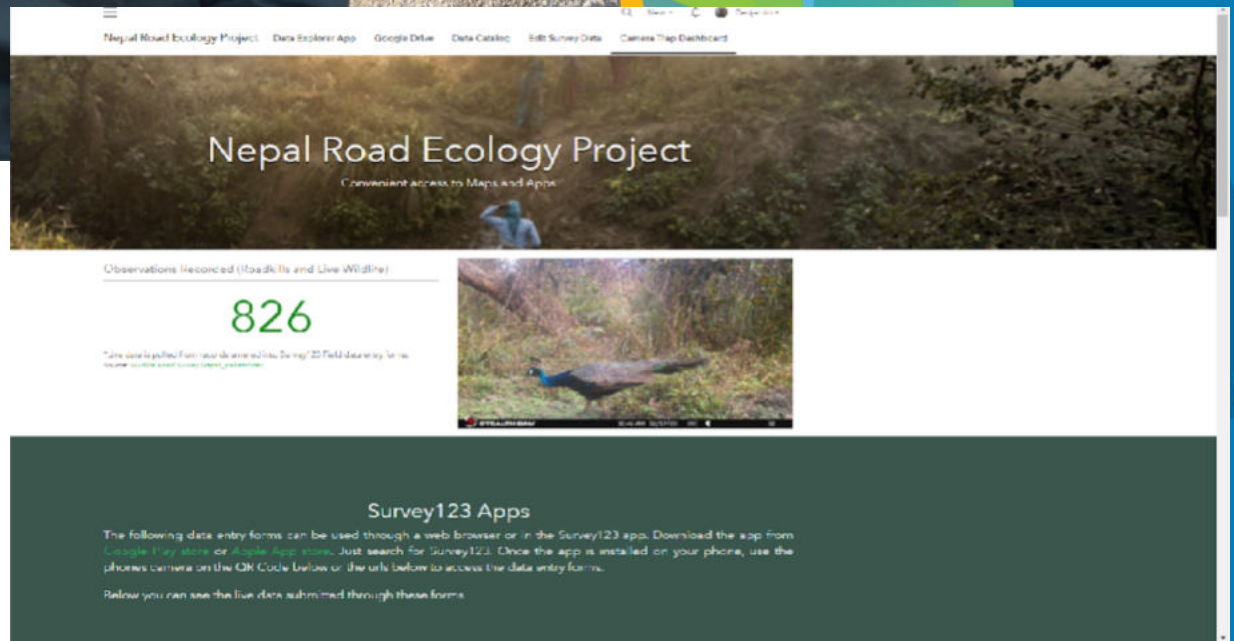
MULTI-TAXA FOCUS

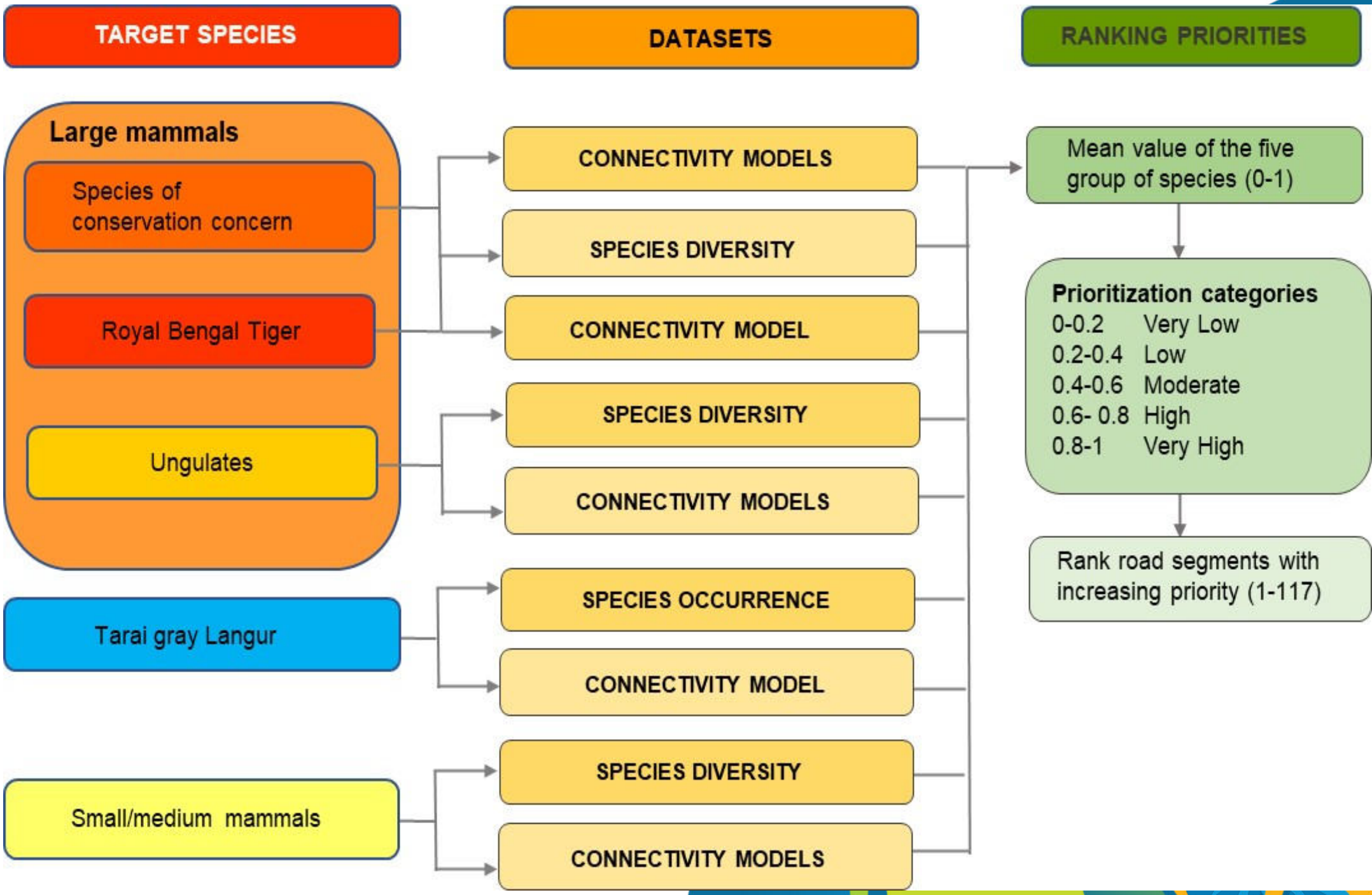
STUDY AREA

METHODS








TARGET SPECIES
DATASETS
RANKING PRIORITIES
Large mammals
Species of conservation concern
Royal Bengal Tiger
Ungulates
Tarai gray Langur
Small/medium mammals
CONNECTIVITY MODELS
SPECIES DIVERSITY
CONNECTIVITY MODEL
SPECIES DIVERSITY
CONNECTIVITY MODELS
SPECIES OCCURRENCE
CONNECTIVITY MODEL
SPECIES DIVERSITY
CONNECTIVITY MODELS
Mean value of the five group of species (0-1)
Prioritization categories
0-0.2 Very Low
0.2-0.4 Low
0.4-0.6 Moderate
0.6- 0.8 High
0.8-1 Very High
Rank road segments with increasing priority (1-117)

RECOMMENDATIONS FOR MITIGATION

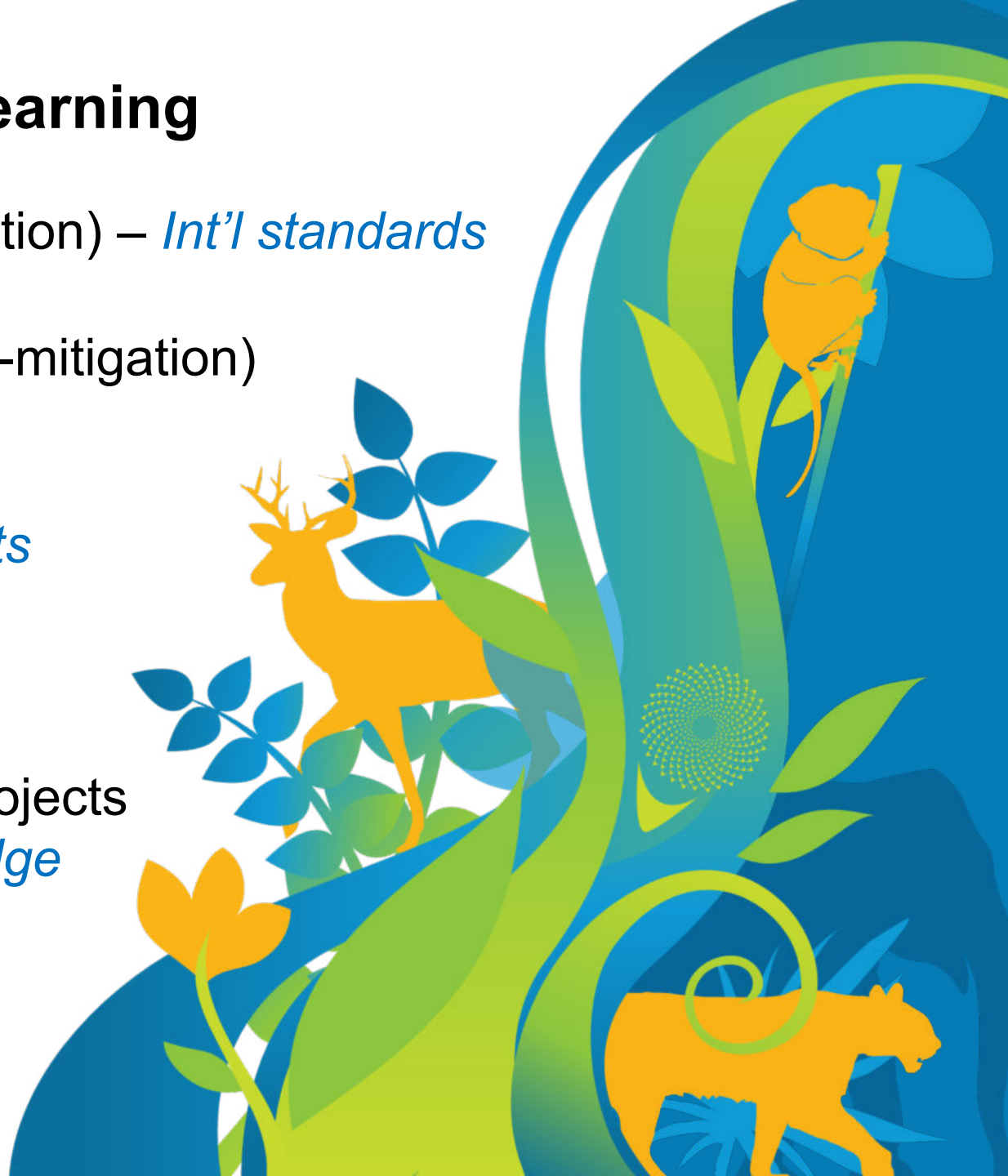
1. Biodiversity Conservation
    - Large Mammals
    - Tarai gray langur
    - Small/Medium-sized mammsls

2. Key Drainages
3. Key Locations
4. Default Drainages

Key Lessons and Learning

"Scientific" approach (planning & evaluation) – *Int'l standards*

Adequate sampling periods (pre- & post-mitigation)
Spurious results
Long-term monitoring and research !
(=model projects) *Rigorous results*

Informing and Integration in early phase

Learning/technology transfer to other projects
Capitalize on efforts and knowledge
Prioritization of key sites is necessary
Wise investments
Partnerships & Coordination
Everyone pays